

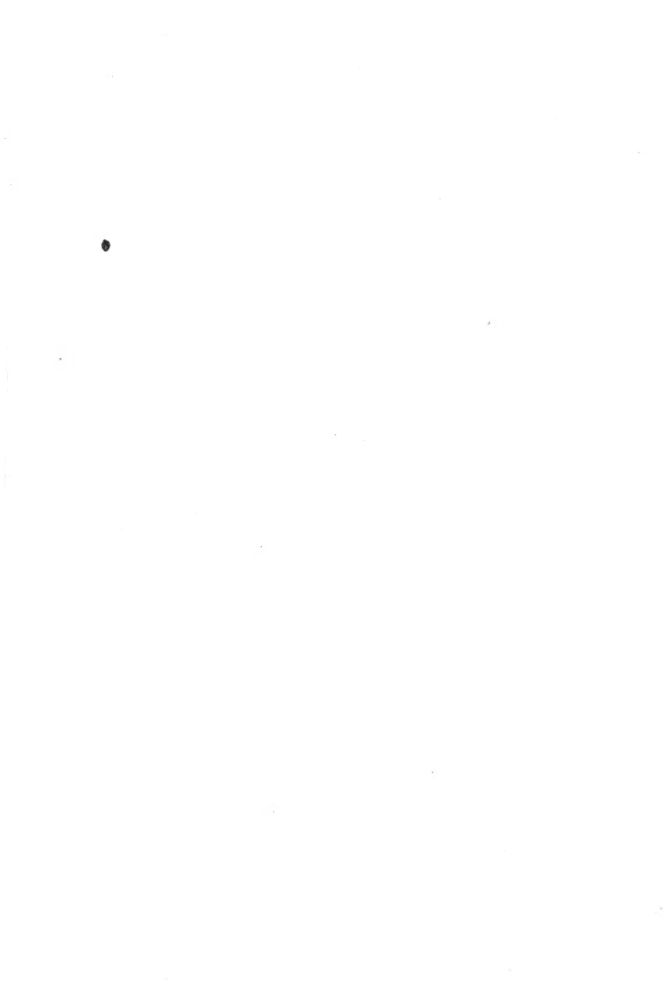
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HOW WE MAKE OUR THREAD.

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HOW WE MAKE
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PREFACE.

This little book is only for the private use of the work-people of the Willimantic Linen Company. It is not a scientific treatise on thread making, but is written with the idea that if each person engaged in the business of thread making understands what has been done to the cotton before it reaches him, and what will be done to it after it leaves his hands, the work will be much more intelligently performed.

W. E. BARROWS,

Pres't and Gen'l Manager.

How we Make Thread.

Q. In making Thread, what kind of cotton do you use?

A. The variety known as Sea Island.

Q. What is Sea Island cotton, and how does it differ from any other kind?

A. Sea Island cotton takes its name from a group of islands on the coast of South Carolina, some ten or a dozen in number, the largest being James, Edisto and St. Helena Islands. The peculiarities of soil, and the surrounding salt water are favorable to the growth of this class of cotton, the characteristics being the length and fineness of staple.

Q. What is Staple?

A. Staple is the individual cotton fibre, which appears to the naked eye to be

round, but under the microscope it is found to be flat, and twisted like a corkscrew.

Q. What is the first process the cotton goes through?

A. The first process is called "ginning," and is the separation of the fibre from the seed. This is done on the plantation.

Q. How is cotton packed for the mill?

A. Sea Island cotton is usually packed in long, round sacks. Upland cotton is baled in a press, under great pressure.

Q. Why are not both kinds of cotton packed alike?

A. It was formerly thought that the long staple cotton would be injured by great pressure, and this class of cotton was therefore packed by a darkey, standing on the cotton in the bag and pounding it down with an iron rod.

Q. But I notice that you have in your mill, cotton packed in square bales as well as round ones. Why is this?

A. We are now trying the experiment, to prove if possible, that Sea Island cotton is not only not injured by pres-

sure, but in fact is benefited. The result of the same experiment last year seemed to prove it. This year we are trying it on a very much larger scale.

Q. *In what part of the mill does the cotton go first?*

A. I will go with you, and show you. This first room is the picker room.

Q. *What are these large piles of cotton for?*

A. This is the cotton as it is taken from the sack, ready for the first machine, which is the picker.

Q. *Why do you not take the cotton direct from the sack, instead of making these piles?*

A. Each lot of cotton, as we receive it from the South, is supposed to be of nearly uniform grade and length of staple, but varies more or less. A bag is opened and the cotton spread on the floor, making the foundation of the pile. The next bag is spread on top of that, and so on, until the quantity of cotton to be used during the week is piled up. The man tending the machine takes off cotton from the face of the pile, and in that

way he takes a part of each bale, the result being that the cotton is thoroughly mixed.

Q. *What is this man doing?*

A. He is weighing a certain quantity of cotton to put in the picker machine.

Q. *Why?*

A. You will notice on the picker aprons (these travelling bands, made of strips of wood, a yard wide), that there are three strips painted black, and here are three more strips painted black, the distance between these groups of strips being just two yards. Now if the man weighs four pounds of cotton, and evenly distributes it on this 2 yards, we have on each yard two pounds.

Q. *What does this machine do to the cotton?*

A. The cotton passes through this set of rollers and comes in contact with a rapidly revolving beater, which opens the lumps, loosens the sand and dirt, and sends the cotton forward between two perforated cylinders, which condenses it, and carries it to this roll, where it is wound up, and it is then called "a lap."

Q. *What becomes of the dust and dirt?*

A. There is a rapidly revolving fan at the bottom of the machine, which blows the dust and dirt through the pipes which you saw in the room below, and out doors into that tower, which we call a dust tower.

Q. *Does any cotton fibre go along with the dirt?*

A. Yes, a little. The bottom of the tower is covered with a wire cloth. The dust passes through, and the fibre is collected at the bottom and saved.

Q. *What is the next machine?*

A. This next machine with three laps, is called the finishing picker.

Q. *Why do you put the three laps together?*

A. If in any one of these laps the cotton was irregularly laid on, by mixing the three together and bringing the cotton into another lap, called the finishing lap, the chances are that the finishing lap will be more uniform in thickness than either of the other three.

Q. *Why is the picker room separated from the rest of the mill?*

A. On account of the great danger from fire, the insurance companies require, that the picker room should be either a detached building, or a room with a solid wall between it and the rest of the mill, except the necessary space occupied by a door, which must be fire-proof.

Q. *Is there any more danger from fire in the picker room than in any other room in the mill?*

A. Yes.

Q. *Why?*

A. Principally from the fact that here the cotton is first opened, and any hard substance, such as nails, bits of iron, flinty stones, etc., coming in contact with the rapid-running beater, will strike fire, and light the cotton in the machine. You know that cotton burns very easily, and the fire spreads very rapidly. Another source of danger is from matches in the cotton.

Q. *How do matches get into the cotton?*

A. The darkies are very great smokers, and good sleepers, and at noon will lie down and take a nap in the cotton, and drop the matches from their pockets. The

greatest number of fires in the picker is from this cause. This is one of the reasons why our rule regarding the carrying of matches in the mill is so very strict.

Q. Suppose the cotton should take fire, what is the first thing to be done?

A. The water in these pails which you see hanging in the windows should be sprinkled on the fire with these brushes. If there is not sufficient water in the pails, water should be taken from the tank. If the fire, notwithstanding the efforts of the men, continues to increase, and the smoke becomes so dense that the men cannot stay in the room, it is their duty to see that the windows are shut, go out through the card room door, see that it is securely fastened after them, and sound an alarm.

It is expected that if the fire increases, the cap on the automatic sprinkler, which you see fastened at the top of the room will be melted off, and the water forced down on the fire in sufficient quantity to put it out. This expectation that the automatic sprinklers will do their work, in no way relieves the picker men from giving an instant alarm, by sending word to

the overseer of the card room. It is the duty of the overseer of the card room, without waiting for orders, to get a line of hose laid and use the means provided for extinguishing the fire, if he finds that what has already been done is insufficient.

Q. In cases of fire, how do the men behave?

A. We have had a number of fires, but the presence of mind of the men, and the intelligent use of the means at hand, have prevented any serious loss.

Q. You said the insurance companies require a fire proof door; is this tin door fire proof?

A. Yes, one of the best known.

Q. Is a tin door better than an iron door?

A. Yes, because the tin door reflects the heat, and an iron door absorbs it, and becoming very hot, might start a fire on the other side.

Q. Where does the cotton go next?

A. To the card.

Q. What does this card do to the cotton?

A. Straightens the fiber and removes

the imperfections in the cotton, as well as removes the dirt that was not taken out in the picker.

Q. How does the card straighten out the cotton?

A. The lap is taken from the finisher picker and placed upon the card, unwound by the actions of the rolls on which it is placed, carried forward through the feed rolls against the rapidly revolving cylinder, which is covered with wire teeth. The cotton is carried by the teeth and brought in contact with wire teeth that are upon the slats which are placed outside of the cylinder. The cotton, having passed all the slats, is straightened, the fibers laid parallel with each other, and it is then thrown by centrifugal action upon the surface of the smaller cylinder, also covered with teeth, which is called the doffer. While the cotton is passing the slats, motes, imperfect cotton, and dirt that had not been removed by the picker, is thrown into them. This is removed by a mechanical arrangement, called a stripper, which moves the slat away from the cylinder, cleans and returns it to its position, then

moves on to the next one, continuing this operation while the card is in motion. The cotton fiber thrown upon the doffer is removed by coming in contact with a vibrating comb; then gathered in the trumpet into a strand or sliver, and passed down between the two calender rolls to condense it into a smaller space. From the rolls it passes into a long box, called a railway trough, in which there is an endless belt moving, which carries the sliver forward to the end of the railway, to the machine called the railway-head.

Q. Here are ten machines in this line that all look alike; what are they?

A. Cards.

Q. Why do you have these ten cards side by side?

A. So that the product of the ten cards can be conveyed to the machine at the end of the railway trough with the least labor.

Q. The next machine, you say, is a railway head; what is the railway head for?

A. The railway head is placed there for the purpose of doubling the product of the ten cards in line, and reducing it again to a proper weight for the next machine.

Q. When the cotton goes up to the railway head it is a large mass, and when it comes out it is a small strand; how is this done?

A. This is done by causing the surface of the front or delivering roll to move as many times faster than the back or receiving roll as you want one sliver to be smaller than the other.

Q. What is the next machine?

A. The comber lap machine.

Q. What is the comber lap machine for?

A. To put the cotton in a proper shape to be carried to the comb.

Q. How is this done?

A. This is done by placing fourteen strands, taken from the railway head cans, spreading them evenly, and passing them through a set of draught rollers, similar to those on the railway head, and then it is wound up into a lap called the comber lap.

Q. What are those little trumpets for that the cotton passes through?

A. Those are to stop the machine in case one of the strands breaks, to prevent inequalities in the lap.

Q. *Then it is important if one of the strands break, that the machine should be stopped?*

A. Yes, consequently the person tending the machine has to use great care that the stop motions are kept in perfect order.

Q. *What is the next machine?*

A. Comb.

Q. *What does the comb do to the cotton?*

A. The comb is used for the purpose of removing the short fiber, and also imperfections in the cotton not removed by the card.

Q. *What becomes of the short fiber?*

A. It is taken out on the back side of the machine, and called noils.

Q. *How does the comb separate the long staple from the short?*

A. This is a very complicated machine, and can be understood only by watching the machine when it is moved very slowly.

Q. *What is the next machine?*

A. It is a drawing head.

Q. *What is a drawing head for?*

A. For the purpose of drawing the strands from the comber drawing head and

reducing them to a proper size for the next machine following.

Q. *What is the next?*

A. The next machine is the same.

Q. *What is the next.*

A. The next following is still the same.

Q. *Why do you have three drawing frames?*

A. For the purpose of doubling the strands and correcting inequalities in a general way, as explained before, both in the card and on the picker.

Q. *What is the next machine?*

A. It is called a slubber.

Q. *What does the slubber do?*

A. The slubber takes the strand from the drawing can, reduces it in weight, twists it slightly, and winds it upon a bobbin. "This is the first time the cotton is twisted."

Q. *Why is it twisted?*

A. Because the strand is then so small that it could not be wound upon the bobbin or handled, unless this was done.

Q. *What is the next machine?*

A. This is a roving frame, called a first intermediate.

Q. *What does this machine do to the cotton?*

A. It takes two strands from the slubber bobbins, reduces them in weight, again twists them, and winds them upon a bobbin.

Q. *Why do you put two together?*

A. For the purpose of correcting any inequalities that exist.

Q. *What is the next machine?*

A. It is a roving frame, called a second intermediate.

Q. *What does this machine do?*

A. The same as the first, reducing it still more in weight.

Q. *What is the next machine?*

A. It is a roving frame, called the "Jack," or fine frame.

Q. *What does this machine do?*

A. The same as the two preceding machines, reducing it to the proper weight for the spinning frame.

Q. *What is the next machine?*

A. The spinning frame.

Q. *What does the spinning frame do?*

A. It spins the cotton.

Q. *How ?*

A. Two strands from the jack frame are passed through the drawing rolls, as in the preceding machines, and reduced to the proper size for the required number of yarn. When it leaves the rolls, it receives the number of times twist per inch desired, and passes through a guide or pig-tail, which is directly over the center of the spindle. Continuing its way down, it passes under that little piece of bent wire, called a traveler, which is hooked over the flange on the ring; then to the bobbin, where it is wound up, practically as it is in the roving machine.

Q. *Is this the only kind of a spinning machine ?*

A. This is a ring spinning frame, and the other spinning machine is called a mule.

Q. *How do the two machines differ ?*

A. On the ring frame the spindle has only a rotary motion, and is made to revolve per minute a sufficient number of times to twist the yarn as much as desired,

and as much faster as is necessary to wind the yarn on the bobbin after the twist is put in, the traveler controlling the twist.

In the mule the spindles are placed on what is called the carriage, and recede from the draft rolls, at the same time revolving the number of times per minute necessary to give the desired twist to the yarn. After they have passed about fifty-four inches from the draft rolls, the carriage stops, the speed is changed, and the fifty-four inches of yarn that has been spun is wound upon the spindles and is then called the cop.

Q. You speak about the number of turns of twist per inch?

A. The twists per inch are determined by the size of the yarn, the formula being, the square root of the number of the yarn multiplied by a constant, suitable for the length of the staple.

Q. What is the usual constant?

A. The constant for short cotton for warp is 4.60; the constant for filling on short cotton is 3.25.

Q. What is it in the sea-island?

A. In the sea-island it varies from 2.5 to 3, according to the length of the staple.

Q. *You speak about the number of yarn; how is the number determined?*

A. Yarn of such a size that 840 yards will weigh a pound, or 7000 grains, is called No. 1. No. 10 yarn, therefore, would take ten times 840 yards to weigh a pound, and so on.

Q. *Supposing a sample of yarn is given me to determine its size, how shall I do that?*

A. Divide the weight of one yard of No. 1 yarn, which is 8.33 grains, by the weight of one yard of any sample; this will give the number of the sample. For example: the sample measures 10 yards, the weight of which is found to be 15 grains; each yard, therefore, weighs 1.5 grains. Now, dividing 8.33 by 1.5, the quotient is the number of the yarn.

Q. *What are those machines on the overseer's desk?*

A. There are three, a reel, a pair of scales and a twist testing machine.

Q. *What are they for?*

A. The reel and scales are to determine the size of the yarn, as I just explained. With the reel the length of the sample is determined, and with the scales the weight.

Q. *I should think that if when the machine was built, it made the right size yarn, that it would continue so, and there would be no need of the overseer having so much apparatus to care for?*

A. When the machine is purchased, it is required to make a variety of numbers of yarn, and change wheels are furnished for the purpose. If the overseer has been making number 50 yarn, and he is required to make number 60 yarn, the machine has to be changed over, and then, to be sure he is right, he tests the product. If the conditions were always the same, there would be no necessity of his having such apparatus. As the roving will vary in size and the condition of the atmosphere is constantly changing, a good spinner tests his yarn every day, to be sure that everything is right. It is of the greatest importance in the manufacture of thread that the yarn be perfectly uniform, and the

utmost care must be used to produce perfect results.

Q. What is the twist testing machine for?

A. This is to determine the number of twists per inch put in the yarn, which I explained was obtained by multiplying the square root of the number of yarn being spun by a constant, varying from $2\frac{1}{2}$ to 3, in Sea Island cotton.

Q. After the yarn is spun, what then?

A. It is taken to the two-ply doubler, where the bobbins are placed on skewers. The ends from two bobbins are passed through wire guides, then over friction rolls through the guides and under the drop wires, to the spool, where the two strands come together and are wound up on spools.

Q. What does this stop-motion do?

A. If the yarn from either bobbin breaks, it stops the spool that is winding it up: otherwise the product would be only one half the size that it should be.

Q. What is that guide for?

A. That is to prevent any unequal places, or lumpy yarn from being wound

up on the spool. The place that the yarn passes through is about the size of the yarn, and when a lumpy place comes to the guide, it breaks the yarn and stops the spindle, and the person tending the machine cuts out the bad place, ties the yarn together, and starts the spindle.

Q. *What do you do after it is wound on the spool?*

A. It is taken to the next machine, which is called the first twister, where the two strands are twisted together.

Q. *What is that liquid in the trough?*

A. That is water, to set the twist as we say.

Q. *After this where does it go?*

A. To the spooler.

Q. *What does the spooler do to it?*

A. The object of the spooler is to take a number of bobbins from the first twister and wind them on one large spool, so as to have as few large knots as possible in the finished product.

Q. *When you have got them on the large spool, then what?*

A. It goes to the three-ply doubler,

where the product of three spools is wound on another and larger spool.

Q. *This has a stop-motion too?*

A. Yes, in every case where two or more strands are put together, there is a stop-motion used to prevent as far as possible, any inequalities in the finished product. You notice that on the first doubler there were two strands put together, which is called two-ply. Now, if we put three of these two-ply strands together we should have six-ply, or what is commonly called six cord. If we had put three strands together, it would have been three cord, and if we had put four strands together it would have been called four cord.

Q. *Now that you have got the three strands of yarn together, what is done with it?*

A. It is taken to the second twister, which is practically like the first twister, and the product is then called thread.

Q. *Now is it ready for use?*

A. No, it has to go through a number of operations. First, if we wish it white, it has to be bleached, if black or colored, it must

be dyed. It would be impossible to put it through these operations while on the bobbin, and so it goes to the next machine, called the reel, where it is unwound from the bobbin and put into a skein as you see on this machine.

Q. What are those young women doing who are sitting down at the tables?

A. That is the next operation, and is called inspecting. Here each skein is carefully looked over by the inspectors, and imperfections as far as possible are removed.

Q. Then what?

A. After the inspectors have pronounced it perfect, these young men straighten it out, weigh it, do it up in bundles, record the size and quality (either three or six cord), and send it to the store house, until such time as it is wanted for finishing.

Q. Why is thread put up in bundles or bunches?

A. It is put up in bundles of uniform weight so that a large lot can be subdivided into smaller lots, after it has been boiled, and is in a wet state.

Q. Why is it boiled?

A. It is boiled to cleanse it from the natural oil and tannin contained in the fibre; also to free it as much as possible from impurities contracted in the various processes of manufacture. The boiling process also ensures thorough saturation of the goods, so that the subsequent operations of dyeing and bleaching will be more efficient and complete.

Q. *What is done with it after boiling?*

A. After boiling, it is distributed to the men in the dye-house and bleach-house, to be dyed or bleached in quantities sufficient to fill orders for the various shades and colors required.

Q. *Why is it that so much manual labor is required in the various processes of dyeing?*

A. A great amount of labor is necessary because the color must be perfectly even on the goods; because the method of dyeing most colors is a building-up process, requiring the immersion of the goods in a number of different chemical preparations at different times; and because the thread must be kept free and straight and loose without breaking or tangling it.

Q. Why is it that the liquors in which the goods are dyed are of different temperatures?

A. Because the whole theory and practice of dyeing and bleaching depends on the rules of chemical science, and heat is one of the principal factors in determining chemical results.

Q. Why is it necessary to wash the goods so carefully after the dyeing and bleaching is accomplished?

A. It is necessary thoroughly to rinse and cleanse the goods from all loose chemicals in order to prevent the risk of corrosive action after they are dried and finished. Another reason for thorough washing is that it renders the thread more soft and flexible because it is freed as far as possible from matters foreign to itself and takes on a more perfect finish.

Q. What is the next process?

A. The thread is next softened and finished by running it through the hydro-extractor and drying in the drying rooms. It is there inspected, bundled and delivered to the spooling room.

Q. What is the use of the spooling machine?

A. A spooler or spooling machine takes the thread from the skein and fills it on a spool straight and even, preparatory to winding or dressing.

Q. Why is the spooling process necessary?

A. It is an intermediate process which straightens and lays the thread regularly on a large spool, from which it can be drawn without difficulty or danger of kinking or breaking in the subsequent operations of winding or dressing.

Q. Are not all threads dressed?

A. No, they are not. Some threads are dressed for specific purposes, or for certain sewing machines which require a thread finished in that way, but the highest priced threads are generally put up for the market soft finished.

Q. What is the effect on the thread of dressing it?

A. The dressing process puts a high silky finish on it, lays the loose fibres into the body of the thread, brushes the dress-

ing mixture into it equally, and gives it the proper degree of smoothness to keep it from chafing and wearing in the severe tests to which it is put in the high speeded sewing machine.

Q. *What is next done with it?*

A. It is next taken to the winding room to be wound on spools for the market.

Q. *Is the winding machine a foreign machine?*

A. No, it is the invention of Mr. Hezekiah Conant, a former employe of this company, a very ingenious mechanic, who, while in this place perfected the winding and the ticketing machines. Mr. Conant is now the treasurer of the Conant Thread Co., of Pawtucket, R. I., the manufacturers in the United States, of the celebrated Scotch thread of J. & P. Coats.

Q. *What does this machine do?*

A. It takes the thread from the large spools which come from the spooling room, measures the quantity desired, either 200, 300, 500, 600, 1,200 or 2,400 yards, winds it on the spool with perfect regularity, and when the proper number of yards has been

wound stops itself. It also stops if the thread breaks.

Q. Does it do anything else except measure the thread and put it on the spool?

A. Yes, it acts as a detective, and gives notice if the thread is not of the size that is intended should be wound. For example, if the machine was set to wind No. 50, and by any accident some No. 60 or 40 thread should be placed in it, it would show the mistake at once.

Q. How is this done?

A. Each spool is made to receive a certain number of layers of thread of a certain size; and the machine being automatic, if, by accident, the size is changed, and a coarser thread should be wound on the machine, the thread would pile up on the spool. If on the other hand, thread finer than the machine was set for, should be wound on it, the layers of thread, instead of being perfect, would show open spaces. In either case, the work would be slovenly, easily detected by the eye, and after making a few traverses would derange the machine.

Q. How near do you measure the thread and how is it done ?

A. If the machine is set for 200 yards, when that quantity of thread has been put on the spool, the stop motion comes into play. The thread will over-run a little, the quantity depends on the perfect condition of the machine. For methods of accomplishing these different results, I shall have to refer you to the machine itself. It is, like the comber, a combination of a number of intricate mechanical movements.

Q. What are these boards for, on the machine, with holes in them ?

A. The boards are made and marked to receive a certain number of thread. They serve the double purpose of counting the number of spools, and keeping the thread clean.

A. Who takes the thread after it is put on the board ?

A. It goes to the inspectors.

Q. What do they do ?

A. They remove any imperfect thread or imperfect spools.

Q. The thread that they reject; what do you do with it?

A. That is ticketed under another name, and sold at half-price or less.

Q. When it has been inspected, where does it go?

A. To the ticketing machine, where the tickets are cut out and pasted on each end of the spool. This machine is the one referred to as having been improved by Mr. Hezekiah Conant. The usual method of putting on tickets is called "licking" them on. The tickets are printed on sheets of paper, which are afterwards glued, and with a punch and mallet the tickets are cut out. The glue is moistened with the tongue, and the tickets are then stuck on the spool. This method is unhealthy and disgusting. There is no particular economy in the use of the machine, but we use it where ever it is possible, because it is cleaner and more healthy to the workpeople engaged in this department.

Q. You said that after the thread has been wound and inspected, it is then ticketed. But I saw some spools on the winding machine that were ticketed.

A. No, those spools were stamped or printed, and are used for what we call long lengths thread: that is, thread made for manufacturing purposes, where more than 200 yards are put on the spool.

Q. *After ticketing, where does the thread go?*

A. To the packers, who put it up in dozens or packages, as the requirements of our customers may demand.

Q. *What are those little cards that the packers put in with the thread?*

A. They are guarantees of the Willimantic Company that the goods in the packages correspond to the descriptive tickets on the outside. This card is not a spy on the packer at all. It is used so that corrections can be made; no one should be suspected of wrong doing. Of course mistakes will happen; people will forget; no one makes an error intentionally. But it is clearly unfair to suspect all the packers of a blunder, when it is made by one person. And so the cards are of use to prove as much which packer did not make the mistake, as to show who was in fault. The success in our business very largely de-

pends upon the perfection of our goods, and the absolute certainty that when a person purchases a spool of Willimantic cotton, he gets exactly what he paid for. And if there are any workpeople in this country or any other country who have the interest of their employers at heart, they are the workers of the Willimantic Linen Company.

Q. As we have walked through the mills I have seen a room called a coat room, and another called the dining-room. I have seen notices saying "that after July 4th, no person in the employ of the Willimantic Linen Co., shall be continued in their service who cannot both read and write," notices of a singing school, and also of a drawing school. Do you consider these as having anything to do with the manufacture of spool cotton?

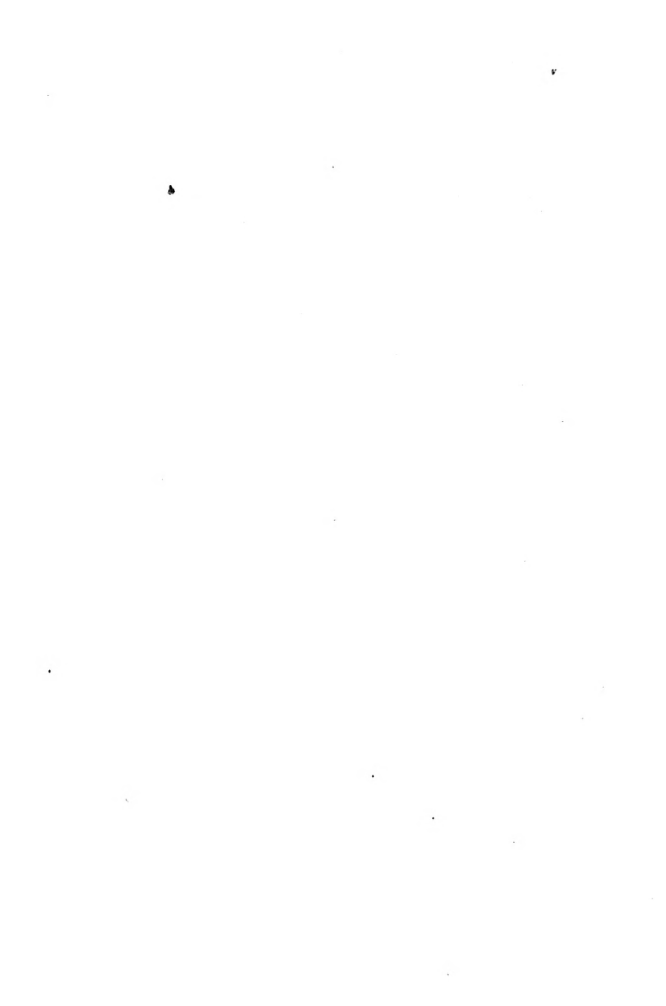
A. Yes. All the way through, I have tried to show the importance of intelligent care of the machines and the material used in making our goods. To do this it is necessary that each person should be able to read and understand our printed rules and regulations and the verbal in-

struction given by the overseers. If the workpeople spend their evenings walking the streets, gossiping about their neighbors, frequenting disreputable and immoral places, they are unfit the next day both mentally and physically, to perform their work or honestly to earn their pay. If, on the other hand, they attend the schools, frequent the library, use the books either at home or in the reading room, their minds and bodies are both improved and rested, they will make better citizens, they better understand the value of life, are of more use in the world and have the satisfaction of knowing that they have honestly earned the wages paid them.

From The New York Sun, Feb. 22d, 1883.—
 “Why is it that the Willimantic thread will lift more ounces of dead weight, and is smoother than any other? Any other manufacturer can buy the same sort of cotton and the same sort of machinery to work it. Why then, the superiority of their product. Simply because it is made by people who know more than any other people in the world engaged in the same work. They put more brains into their

work than others do. They are intelligent enough to know the value of care, intelligent enough to be conscientious about employing it, intelligent enough to know how to apply it with skill to produce the best results. Does it not pay them directly, then, to increase their knowledge? Decidedly."





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